Characterization of Extremophiles Isolated from Spacecraft Assembly Facility

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Systematic detection and classification of the cultivable and non-cultivable microbes present in the Jet Propulsion Laboratory Spacecraft Assembly Facility (JPL-SAF) were carried out using classical microbial phylogeny and advanced molecular microbial ecology methods. This work was done to provide a detailed understanding of the microbial species most likely to contaminate the surfaces of spacecraft hardware and help to identify those terrestrial microbes most likely to contaminate extraterrestrial environments, in-situ life detection studies, or, possibly, returned samples. Contamination of extraterrestrial samples with cells or biomarkers from Earth would seriously compromise interpretation of results of an in situ life detection or space sample return mission. Witness plates made up of spacecraft materials, some painted with spacecraft qualified paints, were exposed for 7 to 9 months and examined for the total cultivable aerobic heterotrophs, and heat-tolerant (80°C for 15-min.) spore-formers. Because of controlled air circulation, desiccation, moderately high temperature, and low-nutrient conditions, the atmosphere of JPL-SAF should be considered as an extreme environment where microbes might find difficult to thrive. The conventional microbiological examination revealed that the JPL-SAF harbors mainly Gram-positive microbes and mostly spore-forming *Bacillus* species. Most of the isolated microbes were heat resistant to 80°C and grew well at 60°C. In contrast, direct DNA isolation, cloning and 16S rDNA sequencing analysis revealed equal representation of both Gram-positive and Gram-negative microorganisms. The phylogenetic relationships among 28 cultivable heat-tolerant microbes were examined using a battery of morphological, physiological, molecular and chemotaxonomic characterizations. Specific findings will be presented, including findings of H_2O_2 resistance. Isolation of microbes that are resistant to H_2O_2 vapor has significant implications for the quality of products in the pharmaceutical and spacecraft industries that currently depend on or plan to use low-heat sterilization technology.